

ABSTRACT

Arc plasma torch generated by a torch module installed on the bottom wall in the narrow section of a tapered S-band rectangular cavity, is used to seed microwave discharge where the microwave electric field is maximum. This tapered cavity is designed to support TE₁₀₃ mode. With seeding, only low Q cavity and moderate microwave power (time average power of 700 W) are needed. The microwave-enhanced discharge increases the size, cycle energy, and duty cycle of the seeding arc-torch plasma considerably. This torch can be run stably without introducing gas flow or run just using airflow. Adding airflow can increase not only the size of the torch plasma but also its cycle energy, which may reach a plateau of about 12 J/per cycle for the airflow rate exceeding 0.393 l/s. This microwave plasma torch may have a radius of about 1.25 cm or more, a height of about 5 cm, and a peak electron density exceeding $5 \times 10^{13} \text{ cm}^{-3}$. This torch may produce an abundance of reactive atomic oxygen, and therefore may be used in applications for rapidly destroying a broad spectrum of chemical and biological warfare (CBW) agents.